CLAIMS

What is claimed is:

1. A signal processing system for use in a receiver comprising:

a training tone extractor that receives a data signal having a plurality of tones and isolates at least a substantial portion of training tones from the plurality of tones in the data signal; and

a noise estimator that computes a noise estimation for the training tones that have been isolated from the other tones.

2. The system of claim 1, the noise estimator further comprising a first noise estimation portion operative to compute a first indication of the difference between an indexed training tone in one burst relative to the indexed training tone in a preceding burst.

3. The system of claim 2, further comprising an index operative to index through the training tones to enable the first noise estimation portion to compute the indication for each of the training tones that have been isolated from the other tones.

4. The system of claim 2, the noise estimator further comprising a second noise estimation portion operative to compute a second indication of the variance and correlation of the first indication computed by the first noise estimation portion.

5. The system of claim 4, further comprising a time averager operative to average the second indication computed by the second noise estimation portion over time.

6. The system of claim 1, the plurality of tones comprising training tones and at least one other type of tone, the system further comprising a beamformer operative to perform beamforming computations for a plurality of tones of the at least one other type

of tone based on the computed noise estimation for the training tone nearest each respective tone of the plurality of tones of the at least one other type of tone.

7. The system of claim 6, the plurality of tones of the at least one other type of tone comprising data tones in the data signal.

8. The system of claim 7, further comprising an indexing function operative to select an indexed data tone from the data tones for which a current beamforming computation is to be performed.

9. The system of claim 8, further comprising a noise selection function operative to select a training tone nearest to the indexed data tone so that the computed noise estimation for the selected training tone can be employed in the respective beamforming computation for the indexed data tone.

10. The system of claim 6, the beamforming computations further comprising computing at least one of soft decisions and noise to signal ratio estimates for the at least some of the other tones.

11. The system of claim 1, the received data signal corresponding to a multiple carrier communications technique.

12. The system of claim 1 being implemented as part of an application specific integrated circuit.

13. The system of claim 1 being implemented as executable instructions programmed in a digital signal processor.

14. A noise estimation system comprising:

an extractor operative to extract carrier signals of a first type from a received wireless signal having more than one type of carrier signal in the frequency domain, the first type of carrier signals being interspersed throughout the received signal and fewer in number than the other carrier signals in the received signal; and

a noise estimator operative to compute an estimate of noise associated with at least a substantial portion of the first type of carrier signals, the noise estimator being operative to provide an indication of the computed noise estimates for the first type of carrier signals.

15. The noise estimator of claim 14, the carrier signals conforming to a multiple carrier modulation format and further comprising at least training tones, data tones and zero tones, the first type of carrier signals being training tones.

16. A beamforming system comprising:

at least one first input that receives an indication of channel estimates for a received data burst;

at least one second input that receives an indication of estimated noise for a plurality of training tones of the received data burst;

a selector that associates the indication of estimated noise for a training tone adjacent a given data tone according to the location of the training tone for which the indication of estimated noise has been computed relative to a location of the given data tone; and

a beamformer that computes an indication of signal relative to noise at the data tones based on the associated indication of estimated noise for each respective data tone.

17. The system of claim 16, the indication of signal relative to noise further comprising at least one of soft decisions and noise-to-signal ratio.

18. A wireless communications system, comprising:

at least one antenna operative to receive a wireless signal and convert the received signal into a corresponding electrical signal;

a preprocessing system operative to process the electronic signal and convert the electrical signal from the at least one antenna into a digital signal and perform desired preprocessing of the digital signal to provide a preprocessed digital signal in the frequency domain having a plurality of tones, some of the plurality of tones being of a first type and others of the plurality of tones being of a second type, the tones of the first type having a fewer number of tones than the tones of the second type; and

a noise estimator operative to estimate noise for tones of the preprocessed digital signal of the first type and to provide an indication of estimated noise for the tones of the first type.

19. The system of claim 18, further comprising a beamformer operative to perform beamforming computations for tones of the preprocessed digital signal of the second type, the beamforming computations employing the indication of estimated noise for a tone of the first type nearest each respective tone of the second type.

20. The system of claim 19, the tones of the preprocessed digital signal conforming to a multiple carrier modulation technique in which the first type of tones corresponds to training tones and the second type of tones corresponds to data tones.

21. The system of claim 20, further comprising a selection system operative to determine which training tone is nearest a given data tone, such that the indication of estimated noise for the training tone nearest the given data tone can be employed in the beamforming computation for the given data tone.

22. A receiver system, comprising:

means for receiving a least one digitized signal in the frequency domain;

means for extracting training tones from the at least one digitized signal;

means for estimating noise for the extracted training tones; and

means for providing an indication of the estimated training tone noise for the extracted training tones.

23. The system of claim 22, further comprising means for performing at least one beamforming computation relative to data tones associated with the at least one digitized signal as a function of the indication of estimated training tone noise.

24. The system of claim 23, further comprising means for determining which of the extracted training tones is nearest a given data tone and using the indication of the estimated training tone noise for the nearest training tone in the at least one beamforming computation for the given data tone.

25. A method for processing a digitized frequency domain signal having training tones and other tones, comprising:

isolating at least a substantial portion of the training tones from the digitized signal in at least one data burst;

estimating noise for each of the isolated training tones; and

providing an indication of the estimated noise for the isolated training tones.

26. The method of claim 25, further comprising computing an indication of the difference between a given training tone in the at least one data burst relative to the given training tone in at least one data burst that preceded the at least one data burst.

27. The method of claim 26, further comprising computing an indication of the covariance for the computed indication of the difference.

28. The method of claim 26, further comprising time averaging the indication of the covariance to provide a time averaged indication of training tone noise.

29. The method of claim 25, further comprising performing beamforming computations for the data tones based on the indication of the estimated noise for the isolated training tones.

30. The method of claim 29, further comprising determining which of the isolated training tones is nearest a given data tone and using the indication of the estimated noise for the nearest training tone for the beamforming computation for the given data tone.

31. A digital signal processor having computer-executable instructions for performing the method of claim 24.

32. An application specific integrated circuit configured to implement the method of claim 24.